

# The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XLVI. No. 1189.

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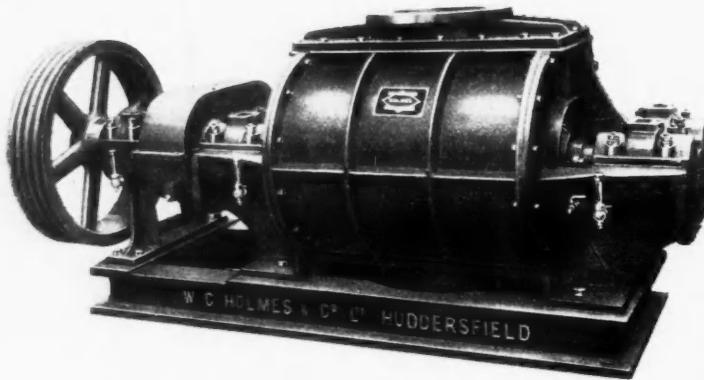
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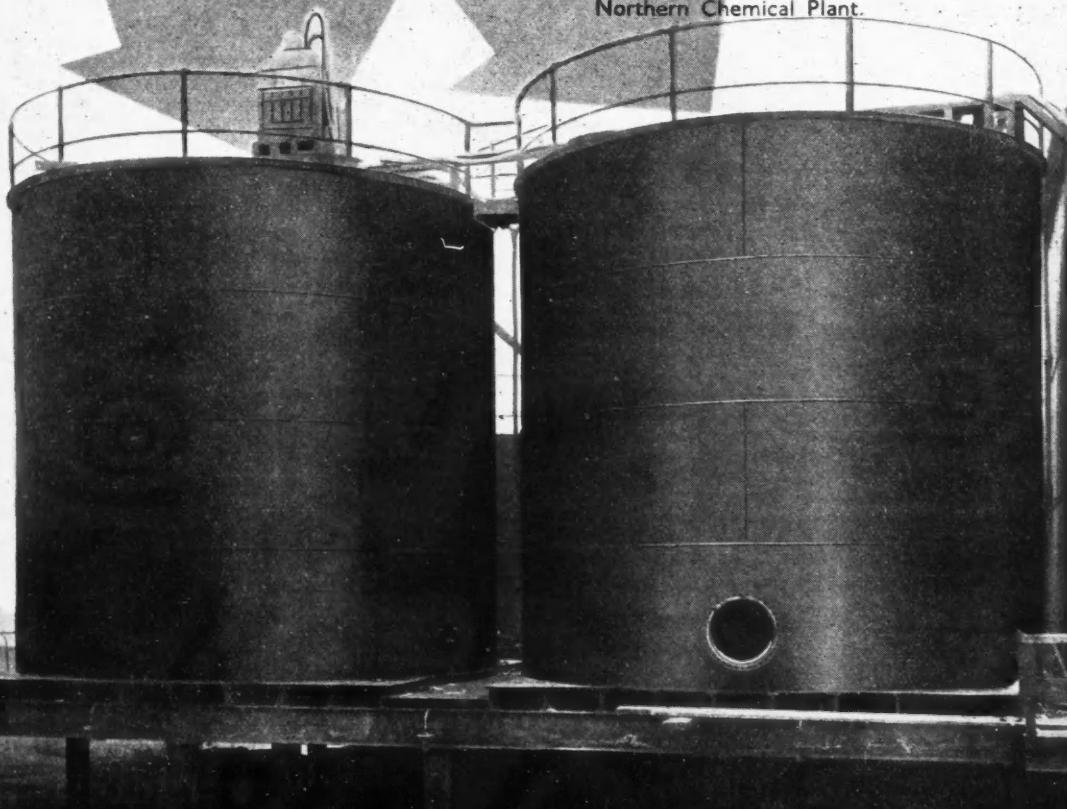
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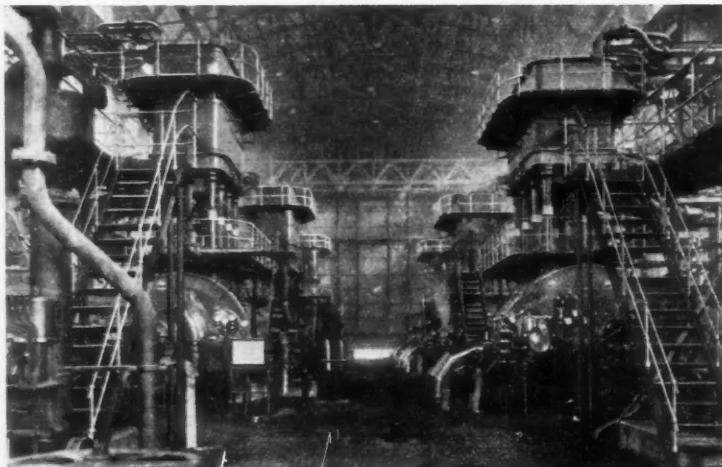
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## Scientific Advances in Fermentation

ALe has for many a hundred years been a staple drink of the English and in a slightly different form its popularity is as great on the Continent. It is not surprising, therefore, that Governments have kept a fathery watch on the processes of its manufacture and that scientists have taken a close interest in the chemical and physical reactions involved in its production. The résumé of the technique of brewing which Mr. A. J. Curtin Cosbie has recently given in his Cantor Lectures to the Royal Society of Arts contains a welcome account not only of the elementary technique of brewing, but of scientific advances in the theory of fermentation during the present century. The interest of Government is shown by the fact that in addition to the close attention given to the industry by the Excise Authorities, under Act of Parliament a brewer is only allowed to use barley malt, hops, sugar, and yeast for the brewing of beer. No other material can be used without the sanction of the Commissioners of Excise. The Excise Officer, moreover, has access to the brewery, can examine what materials he pleases, take samples and, in short, exercise as much supervision over the process as he desires. There is probably no other beverage produced in this country under more strict supervision or under more hygienic conditions than beer; that should be a comfort to the thirsty.

In the history of fermentation research are many great names—Lavoisier, Gay-Lussac, Liebig, Dumas, Pasteur, Berthelot, Claude Bernard, Duclaux, Buchner. The interest of fermentation for all these eminent chemists lay in the fact that it exhibits, as Lavoisier observed, "one of the most striking and extraordinary reactions presented by chemistry." The statement of the fundamental reaction, though really due to Lavoisier, was given in precise terms by Gay-Lussac as occurring in accordance with the formula,  $C_6H_{12}O_6 = 2C_2H_5OH + 2CO_2$ . Lavoisier, who had arrived at exact conclusions from erroneous analytical data, stated that the molecule of sugar is divided by fermentation into two parts and that alcoholic fermentation comprises processes of oxidation and reduction. Recent researches show that an appreciation of these two processes is necessary to an understanding of the intimate mechanism of the decomposition of the sugar molecule in the course of fermentation. The further discussion of the work of the last 20 or 30 years contained in Mr. Cosbie's paper is no doubt common knowledge to the scientific brewer, but is less well known to workers in other spheres. It is of interest to follow the immense complexity of apparently simple reactions. We shall discover through this example that when the processes of nature are unfolded they are rarely simple, even though capable of

overall expression in simple terms such as the Gay-Lussac formula for alcoholic fermentation. Their complexity is emphasised in biochemical processes.

Forty-five years have passed since the first alcoholic enzyme was isolated—a tremendous discovery. It is now recognised that these enzymes may be regarded as organic that of inorganic catalysts, the similarity is close enough for enzymes to be defined as active biochemical catalysts, of enzymes to be defined as active biochemical catalysts, of definite organic nature, with specific activities, formed in living cells, but acting independently of those cells. Yeast is a storehouse of enzymes and appears to contain whatever enzymes are necessary for the several reactions of alcoholic fermentation.

Gay-Lussac suggested a molecule of glucose as his starting point, but as wort does not contain much glucose, but rather the disaccharides maltose and sucrose, complications are immediately evident. It is therefore necessary to hydrolyse sugars to monosaccharides. Through enzyme (hexokinase) action the sugar molecule is converted into an "active" form which is readily susceptible to further change and the first enzyme attack seems to be possible only with this form. The active sugar molecule now combines with two molecules of phosphate and at the same moment or immediately afterwards the six-carbon disaccharide atom is split into two parts each with three carbon atoms, this cleavage being again brought about by a third enzyme (zymohexase). The cleavage products may be regarded as simple sugars with three carbon atoms, but they are also combined with phosphates. They actually consist of glyceric aldehydes which then react, again requiring the presence of appropriate enzymes, with acetaldehyde, whereby one of the two cleavage products is reduced to the corresponding alcohol, while the other is reduced to the corresponding acid, the process being thus one of combined oxidation and reduction, as Lavoisier

stated so many years ago. After the aldehyde reaction, the glyceric acid loses the elements of water, and yields pyruvic acid,  $CH_3CO$ . COOH, and this is the moment at which the combined phosphate is detached. The pyruvic acid is next split up by the enzyme carboxylase to acetaldehyde and carbon dioxide. While the acetaldehyde is used as what is called an "acceptor" in this reaction, *viz.*, the dehydrogenation of glyceraldehyde, the carbon dioxide and alcohol are liberated as the products of fermentation.

This, to use Mr. Cosbie's own words, "with the utmost brevity, is the modern conception of the mechanism of alcoholic fermentation, or the disruption of a molecule of sugar into the final products alcohol and  $CO_2$ ."

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## NOTES AND COMMENTS

### E.P.T. and Plant Renewal

**A** GOOD deal of undigested nonsense has been published and talked concerning our trade after the war, and it is therefore all the more encouraging to read the opinions of a man who has evidently given some thought to the subject, as in the letter which Dr. Herbert Levinstein addressed to *The Times* last week. One of the chief bugbears of post-war trade is likely to be the obsolescence of plant, and, as Dr. Levinstein justly points out, E.P.T. is a dreadful offender in this respect, in that it makes no allowance for plant renewal. Indeed, many firms would not be making a profit at all if proper allowance were to be made for this necessary provision. One result of this is that firms are unable to spend time and money on research which would be of inestimable value ultimately; as the writer points out, Du Pont's spent ten years of research and employed 230 chemists on the development of nylon before they were able to bring it into production.

### A Brake on Research

**W**ITHOUT constant progress industry cannot survive, and the economists and bankers—not forgetting H.M. Treasury—who evolved the principle of E.P.T. as it at present stands, have here a pretty problem awaiting solution. After the war industry seems likely to find itself with obsolete installations and without money to replace them, and it seems logical now to give consideration to Dr. Levinstein's suggestions for alleviating this situation. "We are a country rich in coal," he says. "Let us provide the industries that need cheap power with power at a proper cost. In certain areas power charges are quite fantastic. Even to-day we have no Fischer-Tropsch plants . . . which furnish the Germans with diesel oil and lubricating oil, edible fats and fats for soap. Coal and water are the only raw materials." Until it is lawful for out-of-date plant to be written off against profits, we do not feel that it is likely, or even possible, that chemical engineers (for example) will plunge into the research required for the provision of plant to operate a process which so far this country has neglected altogether.

### A Ministry of Fuel

**A** DDRESSING the Fuel Luncheon Club a few days ago, Dr. E. W. Smith, Director-General of Gas Supply, gave an interesting answer to the question "What do we want?", a broad proposition which he had purposely chosen as giving him scope to discuss almost any matter of interest to the fuel industries. The subject of fuel, he said, was more important than any other with which the Government would have to deal in the future, and, with this in mind, he sketched out the possible formation of a Ministry of Fuel. He recalled that Sir Andrew Duncan, as President of the Board of Trade, had, with his usual foresight, brought about the combination of electricity, gas, oil, and coal within the Board of Trade, so that that department was concerned with the development of all those industries. That being so, the necessity for a Ministry of Fuel was partially disposed of. One could conceive that a Ministry of Fuel would have two functions or types of function, one being routine, the other exploration and policy. If a Ministry of Fuel were to be formed merely to co-ordinate those four entities, he believed it would fail. Indeed, that was not the real purpose of a Ministry of Fuel; that could be done quite readily within the Board of Trade by internal organisation, and it would be done.

### Advice on Fuel Requirements

**C**OMING to his own conception of a Ministry of Fuel or its equivalent, Dr. Smith said that perhaps it was wrong to describe it as a "Ministry." There should be an entity of a very high order, close to the Cabinet, to advise the Government, and it should consist of independent people who had no axes to grind. No vested interests should be connected with it, but its personnel should be highly trained, and should make a thorough study of the

whole fuel requirements of the country. Dr. Smith emphasised his reference to the country's "fuel requirements," because he did not believe that the success of the coal-mining industry depended on how much coal was raised; he believed that the success of that industry was reflected by the way in which coal was used. The body he had in mind would study how best the country's fuel requirements could be met from the resources available, and from an independent point of view; it would have such a status that it would be able to advise the highest authority, *i.e.*, the Cabinet, on fuel policy. That was not being done to-day; but it should be done.

### Vested Interests Barred

**I**T was most important that we should not create a Ministry of Fuel or equivalent body until we had a definite idea of what we wanted it to do. But it must be an independent body which would not consider as one of its duties the bolstering up of any one of the sections of the fuel industries. One could imagine, he said, what a terrible set-up there would be if, due to pushfulness or enthusiasm, an individual such as himself should have a lot to do with the suggested Ministry of Fuel, because obviously he would be working all-out for gas; similarly, a man connected with the electrical industry would be all-out for electricity; and so on, because such men would conceive it to be their duty to do their best for those who paid their salaries. That was natural: the same argument would apply to those concerned with coal and other of its products. The suggested Ministry should certainly take advantage of the services of such men as witnesses; but no one with vested interests should be charged with the direction of the Ministry.

### Co-ordinated Research

**O**N the question of research, Dr. Smith said that the whole development of the future depended upon it, and in the first instance upon fundamental research. The surface of the problem of research into coal and heat, in industrial heating furnaces, and so on, had hardly been scratched; it was only in recent times that we had started to discuss how coke could best be used, and we were just beginning to know something about it. The work of the British Coal Utilisation Research Association, representing the coal industry, should be co-ordinated with that of the Gas Research Board, the coke research organisations connected with the coking industry, and the fuel research of the iron and steel industry, and should be housed and controlled and directed in one of the most comprehensive research organisations ever conceived. The electrical industry was already supporting the work of the British Coal Utilisation Research Association. Why should not all the research work on fuel be co-ordinated in one comprehensive organisation, with one of the country's finest administrators in control, but with separate directors for each branch of the work?

### Linseed Straw in India

**I**NVESTIGATIONS are being carried out by the United Provinces Government on the commercial potentialities of linseed straw in India. At present over a million tons of this straw are consumed as fuel, which, if properly utilised, could bring in an annual income of Rs. 2,50,00,000 (250 lakhs). Indian linseed is mostly of the oil-breeding variety, which does not, as a rule, yield good fibre; but even so, the fibre extracted after threshing the seed would certainly be superior to some of the present substitutes for flax fibre. Investigations are still in progress with regard to bleaching and softening the fibre, but experiments already carried out at the Harcourt Butler Institute in Cawnpore prove that the fibre is strong, and although not entirely suitable for replacing fine linens, is extremely useful for many purposes, including the manufacture of the finer types of paper and in the textile industry. In order to establish the linseed fibre industry it would, of course, first be necessary to provide fibre-producing factories and centres where fibres of standard grades could be packed and despatched to the factories.

# Dextrines and Semi-Dextrines from Minor Starches

## I. Standard Processes with Potato and Maize Starch

by R. L. DATTA, D.Sc., and P. K. CHATTERJEE, M.Sc.\*

THE aim of the investigations here described is to standardise the processes of the manufacture of dextrines and semi-dextrines from potato, maize, wheat and other minor starches. Commercial dextrines are more or less of indifferent quality and in some cases too off-coloured to admit of the finer uses of dextrine. Good potato dextrine made by the best makers is too expensive for general use, and even this has a certain amount of colour. Maize dextrine of a pale colour and full translucent solubility has not been prepared before, and the commercial samples are extremely dark-coloured. It is claimed that by following the processes now standardised, the palest possible qualities of dextrine with the best solubility consistent with the nature of the starch can be obtained at a small cost in heating and stirring only. In commerce, if whiteness is stressed, it will invariably be found that the dextrines are underdone, lacking solubility, and failing in the dextrine test, while if full dextrinisation is wanted, the dextrines are always off-coloured.

The manipulation developed for the manufacture of dextrines is applicable to both potato, maize, and rice starches, the difference being in the optimum percentage of acid necessary for each, the temperature of the baths necessary in each case, and the time of dextrinisation. These conditions have been developed with the closest scrutiny under practical experimental conditions based on preliminary laboratory experiments.

The apparatus used on a semi-commercial scale consists of a shallow round pan made of sheet copper with a flat bottom. This is placed inside an outer iron pan providing an annular space for the heating medium. For purposes of accurate control, the best heating medium has been found to be the standard saline bath known as HTS (*Chem. Age*, 1940, 43, 100). The standard composition of 40 per cent.  $\text{NaNO}_2$ , 7 per cent.  $\text{NaNO}_3$  and 53 per cent.  $\text{KNO}_3$ , freezing at  $142^\circ\text{C}$ ., will be very suitable, as the minimum temperature employed in the process of dextrinisation is higher than the above temperature. Besides, the temperatures of dextrinisation being not very high, the same bath would last almost indefinitely without suffering any decomposition.

As there is a limit to the size of hand-operated round pans, boat-shaped pans with a shallow and flat bottom can be designed, which may be as wide as can be conveniently stirred by hand and as long as desired. As the loss of heat by self-cooling is less in big units, bigger pans will be found more economical. Large-sized round pans may also be designed with mechanical stirring arrangement. The width of the stirrer may not be higher than the layer of dextrine to be used, so that the bottom dextrine during stirring is collected up and redelivered past the stirrer. The stirrer should graze the bottom up to the wall very closely so that new layers are continually exposed to the action of the heated pan. It may be noted that, when once the pan is heated to the correct temperature, charge after charge can be finished continuously with some additional heat to maintain the temperature of the bath. In the processing of the starch, which involves the moistening of the starch with the optimum quantities of water and  $\text{HNO}_3$ , and pre-drying before dextrinisation, a combined drying and sifting machine will be found suitable.

### Dextrine from Potato Starch

The dextrinisation of potato starch does not seem up to now to have reached as accurate a stage of control as is possible. Experiments have been conducted to determine the correct conditions of dextrinisation of potato starch, whereby it would become possible to produce a dextrine having as pale a colour as the starch itself and maintain-

ing the same powdery condition during the process of conversion, while the resulting dextrine would give full dextrine test and clear solubility in cold water. It will be seen that the process developed can be as successfully operated on a small scale as on a systematic commercial scale.

### Acid Catalysts

Both nitric and hydrochloric acids are used in the dextrinisation of starch, but experiments prove that hydrochloric acid behaves drastically, resulting in an off-coloured product, and is not very suitable in the dextrinisation of starch. Nitric acid has been found to be the best catalytic agent for the purpose. The optimum proportion of nitric acid has been experimentally determined. It has been found that when the nitric acid is in excess of what is just necessary, the dextrine test comes first and the clear solubility comes later. Again, when the proportion of nitric acid is less than what is just necessary, the solubility comes first and the dextrine test is much delayed. It is when the dextrine test and clear solubility come simultaneously that the optimum proportion of nitric acid required is reached for yielding the palest possible dextrine with water-clear solubility. Experiments conducted in a drying chamber, heated by a strong aqueous solution of calcium chloride to  $118\text{--}120^\circ\text{C}$ ., gave the following results:

Amount of strong $\text{HNO}_3$ used per 100 g. starch	DEXTRINE-TEST DEXTRINE		CLEARLY SOLUBLE DEXTRINE	
	Time	Colour	Time	Colour
.25 c.c.	5 hrs.	Colourless	5 hrs.	Colourless
.3 c.c.	4 hrs.	Almost colourless	4½ hrs.	Almost colourless
.4 c.c.	2½ hrs.	Colourless	5 hrs.	Light yellow
.5 c.c.	2½ hrs.	Very pale	5½ hrs.	Light brownish

It will be seen from the above that the dextrine test is hastened by higher percentages of acid with much adverse colouring of the product.

A further experiment conducted at a temperature of  $135\text{--}140^\circ\text{C}$ . with 0.2 and 0.25 c.c.  $\text{HNO}_3$  gave the following result:

Amount of strong $\text{HNO}_3$ used per 100 g. starch	DEXTRINE-TEST DEXTRINE		CLEARLY SOLUBLE DEXTRINE	
	Hrs. Min.	Colour	Hrs. Min.	Colour
0.2 c.c.	3 40	Very pale	2 52	Almost colourless
0.25 c.c.	1 45	do.	2 0	Very pale

As should be the case, the clear solubility comes first in the case of 0.2 c.c. nitric acid, and in the case of 0.25 c.c. nitric acid the dextrine test comes earlier than the clear solubility. As the result of a large number of experiments, the optimum proportion of conc. nitric acid has been found to be 0.225 c.c. for every 100 g. of starch, when the palest possible dextrine is produced having correct dextrine test and water-clear solubility, and both these come practically simultaneously when working on a pan heated by a bath having a temperature of  $170^\circ\text{C}$ . This temperature, as will be shown later, gives colourless dextrine having correct dextrine test and water-clear solubility in about 45 minutes.

Experiments have also been conducted with the use of small percentages of different metal catalysts. Manganese, cobalt, and copper have been tried singly and in admixture. Experiments go to show that in the case of manganese alone, the dextrinisation is slightly more rapid than when the metallic catalyst is not used. Its use, however, may be dispensed with, if desired, without affecting the colour and quality of the resulting dextrine.

### Water for Mixing with the Nitric Acid

The use of a certain quantity of water for diluting the nitric acid before adding to the starch is of great importance as, for normal and effective dextrinisation, the nitric acid must wet the starch cells uniformly. In experiments undertaken to determine the optimum quantity of water required for the purpose, potato starch was mixed with

\* Industrial Research Laboratory, Department of Industries, Calcutta.

0.5 c.c. strong nitric acid diluted with varying proportions of water. The impregnated and dried starch in each case was heated in the steam oven for 10 hours, with occasional stirring, with the following results:

Water for admixture per 100 g. starch	Coloration with dilute iodine solution	Solubility in cold water
(1) 5 c.c.	Brownish-red—correct dextrine test	A pale yellow product almost soluble in cold water—some unaltered starch interfering with the clarity of the solution
(2) 7.5 c.c.	do.	Better solubility than No. (1)
(3) 10 c.c.	do.	Glass-like clear solubility in cold water

It is thus seen that a certain quantity of water is indispensable for mixing with the acid before the impregnation of the starch with the acid, and the minimum quantity of water needed appears to be 10 per cent. of the weight of the starch. This quantity of water has to be dried off at a low heat either in an air chamber or on the water-bath heated to between 85 and 90° C. before the starch can be heated for dextrinisation, as otherwise bad clots will be formed during dextrinisation and the resulting product will not be uniform and will be contaminated with unconverted or partially converted starch.

### Dextrinisation Temperature and Sugar Content

Other conditions being the same, the speed of dextrinisation is hastened by increased working temperature. The following preliminary data have been obtained using a 16 in. diam. shallow copper pan. The quantity of each charge was 1500 g. and the thickness of the layer of starch in the pan was approximately 1 in. The table indicates safe working temperature without any adverse effect on the colour of the dextrine produced. A lower temperature than the lowest in the table will be found uneconomical. The best operating temperature has been found to be in the neighbourhood of 170° C.

Temperature of outside oil bath	With and without Mn catalyst	Time for full dextrinisation minutes	Content of reducing sugars per cent.
150° C.	With	75	5.46
	Without	75	5.30
160° C.	With	50	5.85
	Without	53	5.01
170° C.	With	47	4.63
	Without	55	4.85
180° C.	With	25	4.99
	Without	35	5.21
190° C.	With	18	5.10
	Without	23	5.46
200° C.	With	14	5.16
	Without	16	5.37

The content of reducing sugars remains at about the same value in all the cases, though there is indication that it is lowest at the temperature of 170° C. Experiments go to show that in dextrinisation with higher proportions of acid, the percentage of reducing sugars is also higher.

Examination of Merck's dextrines of different grades show the following results:

	Reducing Sugars per cent.
Crystalline variety, yellow	4.66
Transparent cake, pure brown	4.99
Yellow powder, not fully converted	3.38

The attaining of the dextrine test is a self-contained process, but the obtaining of a clearly soluble dextrine is essentially an oxidation process or a process in which partial oxidation is imperative and necessary. That is to say, the dextrinisation must be carried out with free access of air.

### Air-Oven Experiments

Parallel experiments in the air oven were conducted. It was found that the unstirred charge gave a partially soluble product much inferior to the one that was stirred every 10 or 15 minutes. In the latter case, the product was not only clearly soluble, but was also obtained more quickly. In fact, clear solubility cannot be obtained if air is altogether excluded. Acidified starch was heated in 8 in. long and 1 in. diam. test tubes plugged at the top with glass wool and loosely covered, inside a calcium chloride bath at 135-140° C., and gave the following results:

Time of heating	D.T. dextrine	C.S. dextrine
2 hrs.	Found ..	Not obtained
3 hrs.	do.	do.
4 hrs.	do.	do.
5 hrs.	do.	do.

These experiments were repeated in 3 in. diam. and 18 in. long copper tubes with substantially the same result.

### Procedure for Practical Manufacture

To obtain the palest and best quality of dextrine, superior quality potato starch has to be employed. The potato starch is homogeneously mixed with the water to which the nitric acid and the metallic catalyst are added. For every 100 g. of starch, 10 c.c. of water, 0.225 c.c. of strong nitric acid (sp. gr. 1.40), and manganese chloride equivalent to 0.02 g. Mn are employed. The acidified wet starch should be dried either in a drying chamber or in a pan heated by water at a temperature not exceeding 90° C. A higher temperature should not be used as the dextrinisation might start prematurely with the formation of bad clots. After the mixture is dry it is next sifted through a 40-mesh sieve and any little clots that may have formed are crushed and passed through the sieve. A free and homogeneous dry powder is obtained which will pass to the dextrine stage in its natural form.

The experiment was undertaken in a 24 in. round copper pan taking a charge of 3000 g. of potato starch, and the starch as spread out had a depth of 1½ in. approximately. Greater thickness in a pan of this size delays the dextrinisation process and interferes with the production of the finest qualities of dextrine with water-clear solubility, because the process must be carried on with free access of air. The completion of the process takes about 45 minutes, and is ascertained by taking out a small scoopful of the product and adding to it 5 times its weight of water, when a water-clear solution having no cloudiness should form. The sample should also be tested for full dextrine reaction with iodine solution. After a charge is finished, it is taken out and the next charge put in, the temperature of the bath remaining the same. A quantity of 3000 g. of potato starch yields on an average 2500 g. of dextrine, that is, 83.3 per cent. of the weight of the starch. It may be pointed out that a good percentage of this loss is due to the moisture usually present in commercial starch.

### Dextrine from Maize Starch

For determining the optimum proportion of nitric acid in the dextrinisation of maize starch, experiments were conducted with varying amounts of conc.  $\text{HNO}_3$  (sp. gr. 1.40), *viz.* (a) 0.1 c.c., (b) 0.2 c.c., (c) 0.3 c.c., (d) 0.4 c.c., (e) 0.5 c.c., using 0.02 g. Mn catalyst in the form of  $\text{MnCl}_2$  for every 100 g. of maize starch. The starch was mixed with the required quantity of nitric acid in water equivalent to 10 per cent. of the weight of the starch. The mixture was next dried and, after sifting, was heated in a chamber heated by paraffin oil to a temperature of 140-145° C. These samples were tested every half-hour with dilute iodine solution, and their solubility in cold water in the proportion of one of dextrine to five of water was checked, in order to find out the progress of dextrinisation, the optimum acid necessary for correct dextrinisation, and the nature of the final dextrine produced. These samples were stirred every half an hour.

It was found that after 4 hours' heating, the best solubility was achieved, and an almost colourless product was obtained in the case of sample (b). The colour of the samples deepened with increased proportions of nitric acid. Samples (d) and (e) were adversely brown, but possessed no better solubility than sample (b). Sample (a), however, was practically colourless, but its solubility was decidedly inferior to that of sample (b). These experiments indicate that the optimum proportion of nitric acid lies near 0.2 c.c.

The dextrines produced in the above experiments only give a thick magma in cold water, and did not possess as good translucent solubility as is possible of attainment under more suitable conditions of working. It was, however, found practically impossible to attain correct solubility under the above conditions of working in a closed bath at the above temperature.

Experiments were next conducted in an open copper

pan having a diameter of 16 in. with a charge of 1500 g. The maize starch was mixed with 0.2 c.c. conc. nitric acid (sp. gr. 1.40), the optimum found in the above experiments, 10 c.c. of water and 0.02 g. Mn catalyst for every 100 g. of the starch. The treated starch was dried as usual. The dextrinisation was done at a temperature of 180° C. It was found that by using this method and a higher temperature as above, the time of dextrinisation as ascertained by iodine test had been shortened to about one hour, though the desired solubility and glossiness could not be fully attained. Increasing the time for heating did not improve the solubility, though the product became somewhat adversely coloured.

This experiment suggested that a higher temperature of dextrinisation is needed for maize starch than for potato starch, possibly on account of the more complex nature of the former starch. An experiment with a charge as above and at a temperature above 225° C. showed good translucent solubility and glossiness, though the product was adversely coloured. From this it was concluded that a higher temperature was imperative to produce the requisite solubility and glossiness in the case of maize starch, while the colour of the product could possibly be checked by using smaller quantities of acid and possibly also by working at a slightly lower temperature.

A large number of experiments indicated that the optimum temperature for dextrinisation should be in the neighbourhood of 210° C. and the optimum acid to be used should be 0.15 c.c. per 100 g. of starch. This conclusion is borne out by the typical results tabulated below. The temperature of dextrinisation was 210° C. in all cases.

Quantity of HNO <sub>3</sub> per cent. in c.c.	Time in minutes	Colour and solubility
(1) .25	28	Inferior solubility do.
(2) .225	30	Slightly better solubility than Nos. 1 and 2.
(3) .20	30	Better solubility and glossiness than Nos. 1-2.
(4) .175	40	Best solubility, with quick diffusion in water, and best glossiness attainable in the case of maize dextrine.
(5) .15	40	Solution even paler than No. 4.
(6) .125	40	Dextrine taken up by water with difficulty, and marked fall in glossiness.

Parallel experiments conducted with .02 g. Mn catalyst and without any metallic catalyst indicated that in the case of maize starch the metallic catalyst has practically no say in the speed and efficiency of dextrinisation, the ultimate solubility, the glossiness, or the colour of the final dextrine produced. This is probably due to the high temperature of reaction, which gives the metallic catalyst no chance to hasten or modify the progress of the reaction.

#### Procedure for Practical Manufacture

Maize starch should be in normal powdery form. If small clots have formed or are present in the original starch, it is necessary to sieve it through a 60-mesh sieve and grind up the coarse clots so that all pass through a 60-mesh sieve. This is important, as any clots present in the original starch will escape uniform conversion, contaminating the resultant dextrine with unconverted or partially converted starch. The starch is mixed with 10 c.c. water to which 0.15 c.c. of strong nitric acid (sp. gr. 1.40) per 100 g. of starch is added. The treated starch is next dried and sifted as usual. The process of dextrinisation is carried out exactly as with potato starch, using a 24 in. round copper pan with a charge of 3000 g. maize starch. The temperature of the bath in this case should be 210° C. The completion of the dextrinisation is tested by its translucent and glossy solubility by means of dissolving a small sample in 5 times its weight of cold water. The dextrine test, however, comes earlier than the solubility test. A colourless dextrine is obtained which gives a pale translucent solution in water. The approximate time required for the dextrinisation is 50 minutes with the above charge. The content of reducing sugars in maize dextrine has been found to be on an average 4.2 per cent. The average yield of dextrine on the weight of the original maize starch is 2570 g. for every 3000 g. of starch, that is, 85.6 per cent. of the weight of the starch. A good percentage of the loss is due to the presence of moisture in the original starch.

(To be continued)

## Income Tax on Weekly Wages A Lancashire Scheme

WHEN the new budget is presented this month, the Chancellor of the Exchequer is expected to say something about the vexed question of income tax on wages. It is well known that many workers are suffering some hardship on account of the time lag between the period of earning and the collection of the tax. Under the existing statutory system, assessments based on April-to-October earnings are collected from wages earned between January and June of the following year. Consequently, hardship may arise in the case of workers whose earnings fluctuate large between winter and summer. Unless they have created reserves during the period of maximum wages, when tax deductions in respect of their previous winter earnings are comparatively small, they are faced with considerable deductions out of depleted winter earnings. The position has been aggravated by the late arrival of assessments and consequent reduction of the normal collection periods, involving substantial increases in the weekly deductions. When the position was relieved by obtaining extensions of the collection period, the difficulty arose again when the extended period overlapped the ensuing one. In certain factories it was found that when wages were reduced by deduction to little more than the statutory minimum, bad timekeeping and absenteeism followed, and production suffered accordingly.

With the object of overcoming these difficulties within their own organisation, Messrs. Campbell and Isherwood, Ltd., engineers of Bootle, have evolved an alternative system of collection which has the unanimous approval of their employees. The man who is assessed with £50 income tax upon earnings of £250 is in fact paying one-fifth of his income in taxation. In other words he is paying 4s. in the £ tax. An effective rate in the £ can, therefore, be simply calculated upon the actual earnings and assessment of every individual, and by deducting that rate from all future earnings, he will meet his liability at the end of a period, although not necessarily within the official statutory period of collection.

#### Hours Saved, Production Increased

The system was introduced during a period of depleted wages and, as it was entirely unofficial, it was necessary for the firm to finance the difference between the amount collected from the individual during the collection period and the amount they ought to have deducted under the official system, to ensure that the Inland Revenue received the full amount of tax to which they were entitled. Written consent from each individual was obtained enabling the firm to continue the deductions at the same rate in the £ during the period of maximum wages, thereby reimbursing to the firm the amount previously advanced to the Inland Revenue. As regards the clerical work involved, it was discovered that although an extra calculation is necessary in arriving at the amount to be deducted from wages each week, this is more than balanced by the time previously used in adjusting deductions occasioned by sickness, statutory minimum, etc. Within one month of the introduction of the scheme, more than 2000 basic hours were gained, together with greatly increased production.

The scheme (which was devised by Mr. F. J. Ferrie) is an unofficial one and is advanced as a possible solution to the present problems, in the belief that it should be operated on a voluntary basis between the management and workers of each concern. Only five men out of the firm's 1000 employees elected to remain on the official system; it was learned later that they were the exceptions who always discharged their income tax in one sum, and never suffered deductions from wages. The scheme was submitted to the Merseyside Executive Committee of the Shipbuilding and Engineering Unions, who gave it their approval, while the Board of Inland Revenue approved the application of the scheme to this company and its branches. It is receiving much trade union support and it has now been brought to the notice of the Minister of Labour and National Service.

## LETTERS TO THE EDITOR

## Fire Risk from Silver Compounds.

SIR.—Dr. Schweig's letter published in your issue of March 28 deals with a very important matter and one which cannot be too widely known among those who deal with metallic nitrates and especially, as in this case, silver nitrate. Those of us who are concerned with the manufacture of this salt on a large scale have learned from experience that a very considerable fire risk results from the proximity to any heat source, of organic material impregnated with nitrate of silver. Wood, paper, and cloth saturated with the salt are especially susceptible to immediate ignition and a stray spark, as for example one obtained from the chiselling of iron, is quite sufficient to cause a conflagration which, once started, quickly embraces the whole of the material. The rapid extension of the fire with the resulting smoke screen of choking fumes effectively hides from view the actual burning and increases the difficulty of dealing with the outbreak. It should be understood that the ignition of the material is not usually accompanied by flame, but consists of a series of sparks running quickly over the whole of the combustible material, similar to the well known phenomenon obtained by the burning of paper impregnated with nitre.

It is, however, not always essential for the silver-nitrate-soaked material to be in an entirely dry state, but there is no doubt that with dry material the temperature of ignition is comparatively low and may certainly be in the neighbourhood of that mentioned by Dr. Schweig. Anyone accustomed to be on the alert for fire hazards of this nature would certainly hesitate to place any potential heat source in close proximity to organic material liable to become saturated with silver nitrate, and one has also to take into account the possibility of electrical short-circuiting in considering these sources.

It is vitally necessary to prohibit smoking in shops where these fire risks exist; the writer has seen a very serious fire resulting from the careless handling of a cigarette.

As your correspondent describes his experience when visiting a glass-silvering shop it might be advisable to refer to a further hazard concerned with the dangerous properties of the silver compounds formed when ammoniacal, potash, or soda silvering solutions are mixed with the reducing solution. In the dry state these dark-coloured compounds are highly explosive and easily detonated by touch, and where deposits of them have been allowed to collect on the edges and bottoms of the containing vessels by evaporation of the residual liquid, serious accidents have occurred. It is therefore advisable to wash out all containers or receptacles of the mixed solutions where there is any probability of the vessels being out of use for any prolonged period.—Yours faithfully,

London, E.C.1.  
April 1, 1942.

JOHNSON, MATTHEY & CO., LTD.  
E. DOWNS.

## Concentration of Rubber Manufacture

SIR.—Arising from the restricted supply of raw rubber, it can confidently be expected that it will not be long before the rubber manufacturing industry is officially listed for "concentration." This will not be a subject with which it will be easy to deal, having regard to the variety of goods which are made under each roof.

It will, however, be obvious to everyone that, apart from the need for concentration in the national interest, there is also the need of the individual manufacturer who finds that he is left with a number of departments which cannot be run efficiently on the volume of rubber licensed for the purposes involved. There is not much doubt that voluntary arrangements to bring about concentration would result in quicker and better results than if an official scheme had to be worked out and applied.

Manufacturers are advised, therefore, to consider what departments in their factories are not likely to bring them efficient results having regard to the reduced volume of production, and to contact with other manufacturers who

will be in similar circumstances, with a view to making some individual bargains which, if the Board of Trade approves, could be adopted without delay.

The India Rubber Manufacturers' Association is prepared to keep a register of those manufacturers desiring to be placed in touch with others in connection with this subject, and to do what it can to make any necessary introduction. The address of the I.R.M.A. is: The Royal Exchange (Rooms 230 and 237), Cross Street, Manchester, 2.—Yours faithfully,

Manchester.

April 7, 1942.

L. V. KENWARD,  
Chairman,  
THE INDIA RUBBER MANUFACTURERS' ASSOCIATION.

## French Hydrogenation Plants

## Standard Oil President's Statement

A N answer to the charges brought by the Assistant Attorney-General of the United States against the Standard Oil Company of New Jersey, has been given by Mr. W. S. Farish, president of that company, to Senator Truman's Congressional Committee, and is reported by Reuter from Washington. In addition to denying the truth of the allegation that as late as 1939 the company was engaged in an effort to establish relations with Japan, contrary to American interests (as noted in our last week's issue), he also denied statements that it had assisted German interests after the fall of France by building a hydrogenation plant in occupied France, and that it had made shipments by Italian and German air lines to Brazil. He admitted that the German corporation D.A.P.G.—a subsidiary of Standard Oil—planned in 1938 or 1939 to erect at Hamburg a plant producing aviation fuel, but added "as a German corporation operating in Germany—with which country we were not then at war—it could not have done otherwise."

Before the outbreak of the European war, he said, discussions were going on in France between the International Hydrogenation Patents Company of The Hague and French groups for a licence for one or more coal-tar hydrogenation plants in France. "Our French subsidiary and the French subsidiary of the British-owned Shell Company were interested in working out an arrangement to market the petrol so made. When the Germans took Holland they put a German commissar in charge of the business of I.H.P., which was owned fifty-fifty by Shell and ourselves, although I.G. Farben were entitled to a 20 per cent. interest in its licensing revenues.

"Following the fall of France the question of these coal hydrogenation plants again came to the fore. There were discussions whether it would be agreeable, in view of whatever equitable interests we might claim in fees from the Dutch company, to permit I.G. to take charge of these negotiations. The alternative would have been to leave them in the hands of the German commissar controlling the Dutch company. This alternative did not appeal to us. We consulted the Shell company, who took the view that they could express no opinion nor take any action of any kind. The matter was therefore dropped. We have no knowledge of what happened afterwards."

Exports of minerals and ores in 1941 from Santos, Brazil, were recorded at 28,100 metric tons, compared with only 2326 tons in 1940. Shipments of bauxite, mainly to the U.S.A., amounted to 15,053 tons, after having fallen to only 82 tons in 1940; formerly large quantities of this product were also shipped to Argentina under a contract with the Buenos Aires municipal authorities. Other products exported last year included 4567 tons of zirconium ores and sands, also chiefly to the U.S.A.; 7500 tons of iron ore and 380 tons of rutile to Great Britain; 347 tons of cobalt and 15 tons of wolfram to Japan. Mica shipments totalled 230 tons and went principally to Japan, while small quantities of nickel were exported to the U.S.A.

# Hydrogen Ion Control in Electroplating

## Advisability of Frequent Measurement

by H. SEYMORE

THE importance of  $\text{pH}$  control is apparent from the fact that research and actual experience in various plants have shown that many of the troubles in nickel electroplating and electrotyping, such as pitting, cracking, curling, too hard or too soft deposits, burnt deposits, etc., are due to incorrect acidity of the bath. Even slight changes in acidity may cause marked effects on the appearance or properties of the deposited nickel.

Nickel electroplating and electrotyping solutions are generally maintained between  $\text{pH}$  5.2 and 6.8. For nickel plating under usual conditions in still tanks, the best  $\text{pH}$  is generally from 5.6 to 5.8. With a higher  $\text{pH}$  (lower acidity), the deposits are softer and may be dull or "burnt." With a lower  $\text{pH}$  (higher acidity), the deposits are harder and brighter, but more brittle. In barrel plating, where the current density is low, a higher  $\text{pH}$ , e.g., 6.0 to 6.2, is desirable. In solutions with a high nickel content, such as are now used in mechanical platers at a relatively high temperature and high current density, a lower  $\text{pH}$ , e.g., 5.2 to 5.4, is often employed. For nickel electrotyping on wax moulds, a  $\text{pH}$  of 6.4 to 6.8 is usually employed. Where solutions are used exclusively for lead moulds, a lower  $\text{pH}$ , e.g., from 6.0 to 6.4 is satisfactory. In any case, if a softer deposit is desired, the  $\text{pH}$  of the solution should be somewhat increased.

The exact  $\text{pH}$  to be used will depend upon the composition of the nickel solution, the working conditions, such as temperature and current density, the class of work, and the finish desired. A few careful  $\text{pH}$  measurements with observations of results, will serve to indicate the preferable  $\text{pH}$ . This can be maintained or reproduced at any time by periodic measurement, and the careful addition of sulphuric acid if the  $\text{pH}$  is too high, or of sodium carbonate, nickel carbonate, or ammonia if it is too low. The  $\text{pH}$  value changes with temperature, and measurements should therefore be made under uniform conditions. When hot nickel-plating baths are employed,  $\text{pH}$  measurements of the hot solutions yield values appreciably different from those obtained when these same solutions are cooled to room temperature. In order to avoid confusion it is most satisfactory to make all  $\text{pH}$  measurements on cooled samples. The  $\text{pH}$  values given above all refer to measurements made at ordinary temperature, that is between 20° and 30° C.

### Adjustment of Anode Corrosion

If it is found that the  $\text{pH}$  of the solution continually decreases and the solution tends to become more acid, this is usually due to insufficient anode corrosion, which can be corrected by increasing the anode area or by adding more chloride, such as ammonium chloride, to the solution. If the  $\text{pH}$  increases, i.e., the solution tends to become alkaline, the anode corrosion may be reduced by allowing the chloride content to decrease or by reducing the anode area.

Plating solutions are often contaminated by rinse water. The final rinse water should not, therefore, be allowed to become appreciably acid or alkaline. To guard against this, a plentiful supply of water should be used.

Recent investigation has shown that the colorimetric and potentiometric (quinhydrone electrode) methods do not give the same  $\text{pH}$  readings in nickel-plating solutions. These variations are due to the high concentration of salts present in such solutions. This does not in any way impair the value of colorimetric  $\text{pH}$  measurements. The plater is interested solely in controlling the bath so as to secure satisfactory work, and in being able to duplicate conditions which give him satisfactory results. This is fully accomplished by the colorimetric method.

More recent studies have shown that the operation of acid zinc-plating baths, such as those containing zinc sul-

phate and zinc chloride, is also greatly simplified by the measurement and regulation of the  $\text{pH}$ . Acid zinc solutions are usually maintained at a  $\text{pH}$  of 3.4 to 4.4. In zinc baths containing aluminium salts, such as alum (aluminium sulphate) or aluminium chloride, satisfactory deposits can be produced within this range. As conditions may vary somewhat in different plants, it is best for the plater to determine, from a few simple tests, the  $\text{pH}$  value best suited for his class of work. At the start it is well to try a  $\text{pH}$  of about 4.0. In general, if the  $\text{pH}$  is too low, the cathode efficiency is low, and the anodes are rapidly attacked when the bath is not in use. If the  $\text{pH}$  is too high, the deposits are coarse-grained, and likely to be dark and spongy.

### Rules for Acid Additions

In a solution containing an aluminium salt, when the  $\text{pH}$  reaches about 4.5 a white gelatinous precipitate appears. This is in itself an evidence that the  $\text{pH}$  is somewhat higher than is usually desirable. It is then best to add acid slowly to the entire bath until, after stirring and allowing it to stand for some time, the white precipitate just dissolves. The  $\text{pH}$  may then be measured and adjusted further if necessary. In general, if the  $\text{pH}$  solution is too high, sufficient acid should be added to produce the desired  $\text{pH}$ . If the bath contains zinc sulphate, sulphuric acid should be used; if it contains zinc chloride, hydrochloric acid should be used. If the  $\text{pH}$  is too low, add ammonia if the bath contains ammonium chloride, or add sodium hydroxide or sodium carbonate if the bath contains sodium chloride. In most cases it will be found that the  $\text{pH}$  of the bath gradually increases, owing to the fact that the zinc anodes are slowly attacked and dissolved when the bath is not in use. It is likely, therefore, that some addition of acid will be required each day. Measurement will show when acid is needed, and when enough has been added to produce the most favourable deposits.

With solutions that contain no aluminium salt, it is possible and may sometimes be desirable, to use a higher  $\text{pH}$ , up to 5.0 or 5.5. As recommended in the case of nickel, measurements should be made at ordinary room temperature (20° to 30° C.) to ensure uniformity.

When tin is being deposited from a stannate bath, the  $\text{pH}$  is high and standards covering  $\text{pH}$  12.0-13.6 are required. The acidity of acid copper baths, such as are used in electrotyping, is so high, and the  $\text{pH}$  so correspondingly low, that it is not feasible to control their composition by  $\text{pH}$  measurements. Special acid-copper analytical sets have, however, been developed for this purpose.

All cyanide plating solutions, such as those of silver, copper, zinc, gold, and brass, are strongly alkaline. No data are available as to the effects of the  $\text{pH}$  of such solutions upon their operation, or the optimum  $\text{pH}$  for any given bath. A few preliminary observations indicate that the  $\text{pH}$  of certain cyanide solutions can at least be measured by means of existing indicators.

An eight-page catalogue, describing their new signalling controller, for use where indicating and recording of condensate purity are not needed, has just been received from THE LEEDS AND NORTHRUP COMPANY, 4901 Stenton Avenue, Philadelphia, Pa., U.S.A. This equipment tests condensate purity continuously; its self-contained signal lights show whether condensate is above a specified minimum purity and is safe to use again, or whether it is below this limit and should be diverted to waste. In addition, the instrument can operate external warning bells or lights, and can provide automatic two-position control by regulating a motor-driven valve to dump impure condensate.

## A CHEMIST'S BOOKSHELF

THE CHEMICAL ANALYSIS OF FERROUS ALLOYS AND FOUNDRY MATERIALS. By E. C. Pigott, with a foreword by N. D. Risdale. London: Chapman and Hall, Ltd., 1942. Pp. 362. 28s.

This volume will be particularly welcome to industrial chemists and chemical engineers, as it deals with the modern practice and theory of its subjects. It contains not only the author's own processes, but also some comparatively modern methods, which hitherto have appeared only in technical journals. The volume embraces the marked advances in analysis necessitated by the recent introduction of complex ferrous alloys and is divided into three sections. The first contains a table of elements, symbols, atomic numbers, atomic weights and isotopes, and very useful definitions, principles, and explanatory data, arranged alphabetically. The second deals in separate chapters with the twenty-eight elements which are used or appear in ferrous alloys, and information on the physical properties, extraction, general and chemical properties, and application precedes the actual methods of analysis, while some account is given of the evolution and the theory underlying these methods. The third section gives an explicit classified description of refractory materials; interpretation of results; analyses of acid materials, lime and limestone, zirconia sand, chrome-magnesia brick, and the theory of the respective methods. A comprehensive appendix includes a survey of rapid analyses of ferrous bath samples and a list of British chemical standards and their compositions. Several illustrations of apparatus for the various determinations, as well as a great number of tables, will prove of great value. The book covers its special subject so thoroughly that it may be called a standard work and the fact that the author, now working for the Department of Scientific and Industrial Research, formerly held analytical appointments with several well-known iron and steel concerns is sufficient guarantee that this book will be of a great practical value for professional metallurgists, assayers, chemists, and students.

THE CHEMICAL FORMULARY, Vol. 5. Editor-in-Chief, H. Bennett. London: Chapman and Hall. Pp. 676. 28s.

Whoever has had in his possession the first four volumes of this admirable series of chemical recipe-books will be delighted to learn that a fifth volume has now appeared. Whoever has not had the good fortune to be so far acquainted with this famous chemical "commonplace book" should take this opportunity of repairing the omission. When such a vast mass of varied information is combined in a single volume the work of the reviewer becomes extremely arduous. Very few people, we imagine, are qualified to speak with authority on both the Kennebec River process for brine-salting shad, and the advantages of cavitamic acid for the treatment of patients with an allergy towards citrus fruits (to take only two examples). When it is learned that both these examples come from the same section of the book, that on food, some idea of the encyclopaedic scope of the work can be gained. No industrial chemist, whatever his line, can afford to be without this volume, which gains new importance in these days when the utilisation of substitutes is so important a consideration in almost all manufacturing processes.

RUBBER AND ITS USE. By Harry L. Fisher. London: Macmillan. Pp. 128. 7s. 6d.

As a handy guide for the manufacturer of rubber, who wishes to have a reasonable theoretical as well as practical knowledge of his subject, this book is of considerable value. It makes no attempt at an exhaustive treatment of the subject, but as a substitute for that it gives an extremely good list of reference works for supplemental reading, which will cover everything that the most voracious seeker after knowledge could wish for. The book itself is divided into ten sections, of which the first three are introductory and historical, while numbers 4 to 7 are concerned with manufacturing processes, including vulcanising and the treatment of latex. The concluding chapters deal in twelve pages with synthetic rubbers and rubber derivatives. The size of the book is handy and the illustrations well chosen.

## Towards Greater Security

Sir Ernest Benn on Future Values

SIR ERNEST BENN, in a statement issued with the 101st statement of accounts of the United Kingdom Provident Institution, of which he is chairman, declares that the accounts and report, with results of the triennial valuation, disclose, in the exceptional circumstances of the times, a position which can only be regarded as highly satisfactory. In these quite exceptional circumstances nearly £2,000,000 of new business had been offered and accepted by them, a very striking tribute to the confidence and esteem in which the Institution and its policy are held.

After a reference to the fact that the Institution exists to provide security, the statement proceeds: "We retain 1938 values to avoid the disclosure of substantial appreciation which we are bound to regard with as much doubt as was applied two years ago to a movement in the opposite direction. Some £10,000,000 of our money is invested on the security of bricks and mortar, and I have yet to meet the expert who will venture an opinion on future values in this field. We have suffered from bombing, but the vagaries of Government policy in the matter of compensation throw doubt upon the value of any calculations of our claims. Putting these considerations together, we have kept our freeholds, leaseholds, and mortgages at the figures of the 1938 valuation, adjusted only by our automatic contributions to reserves by new purchases and by actual realised profits. We have applied the same principle to our Stock Exchange securities, although on the assumption that official prices as at December 31, 1941, could be obtained, we have a substantial hidden reserve."

"Fifty years ago the Institution led the way in establishing the safest basis of insurance valuation. We were

one of the pioneers of  $\frac{1}{2}$  per cent. Your directors have deemed it wise to strengthen further the basis of valuation. We are now adopting a rate of  $\frac{1}{4}$  per cent. for all with-profit policies, and are once again taking the lead towards greater security."

After explaining the Institution's policy on the question of bonus, Sir Ernest's statement touched on their new subsidiary, The United Kingdom Fire and Accident Insurance Co., Ltd., the first year's accounts of which disclosed a thoroughly satisfactory position.

## Synthetic Fibre Industry

German Efforts towards Improved Economics

AN institute for the chemistry and technology of synthetic fibres has been opened recently at the Technical College of Breslau, Germany. In the address given on that occasion by Dörr, the director-general of the German synthetic fibre industry, it was pointed out that important economic changes are now being effected in the industry. The raw material basis has been broadened by the use of pine-wood and straw, and costs have been reduced by application of the continuous process and selection of a method of treatment calculated to provide the best material for the special purpose in view. More intensive utilisation of wood has been made possible by preparatory hydrolysis. As more and more raw material is needed for the synthetic fibre industry, the cost of transport over long distances grows in importance. Hemicellulose is to be used for the manufacture of protein, fatty and resinous acids, pectins, vanillin, waxes, etc. Special attention is to be paid to the recovery of chemicals used in the manufacture of synthetic fibres, even at increased cost, if this helps to reduce transport requirements.

## Personal Notes

LORD DUDLEY GORDON was on April 1 elected President of the Federation of British Industries for the third successive year.

DR. RAYMOND R. ROGERS, F.C.I.C., has been appointed chief chemist of the Welland Chemical Works, Niagara Falls, Ontario, Canada.

MR. H. A. R. RUSSELL, secretary of Savory and Moore, Ltd., has been appointed a director of the company, but will continue to hold the office of secretary. MR. S. G. STEVENSON has joined the company as technical adviser.

MR. J. W. ADAMSON, managing director of British Paints, Ltd., has been elected chairman of the newly-formed Newcastle-upon-Tyne Section of the Oil and Colour Chemists' Association.

MR. W. E. PATTERSON, F.C.I.C., has been appointed to take charge of technical operations in the manufacturing extensions which are being planned in Canada by Merck and Co., Ltd., Montreal, including the production of certain chemicals not hitherto made in Canada.

SIR GEORGE BEHARRELL has been appointed to the new office of Director-General of Controls in the Ministry of Supply. Sir George, who is chairman of the Dunlop Rubber Co., and of the Rubber Control Board, has had many appointments, including that of president of the Federation of British Industries.

The following were elected officers of the Nottingham branch of the Society of Chemical Industry at the annual meeting on March 28: chairman, MR. A. D. POWELL; vice-chairman, DR. G. M. DYSON, MR. G. N. HODSON, MR. D. J. LAW, DR. E. B. R. PRIDEAUX; hon. treasurer, MR. C. F. WARD; hon. secretary, MR. W. T. T. AINSWORTH; committee, DR. H. H. BARBER, DR. W. F. ELVIDGE, PROFESSOR J. M. GULLAND, DR. F. L. PYMAN, DR. T. A. SMITH, MESSRS. L. ANDERSON, H. CALAM, T. F. HEYES, F. W. MOULDS, G. H. ROME, W. W. TAYLOR, and W. WOODHOUSE.

## Obituary

MR. JOHN KEVAN GREENHALGH, who died suddenly on April 1, was formerly on the board of Lever Brothers, Ltd., Port Sunlight, having served as deputy-director and director, on the financial side, in 1910-15.

MR. THOMAS HAROLD BRADLEY, who died recently at Chesterfield, aged 72, established a chemist's business in Staveley in 1899 and remained there until he retired in 1922. His father, Mr. James Bradley, was a chemical manufacturer in Chesterfield; his son, Dr. A. J. Bradley, F.R.S., is a leading authority on metals and alloys.

## New Control Orders

### Lead and Chromium Compounds, etc.

COLLAPSIBLE containers of lead or tin, and a number of additional chemicals will be subject to export control on and after April 21, 1942, under the Export of Goods (Control) (No. 15) Order (S.R. and O. 1942, No. 578) made by the Board of Trade. Licences will, in future, be required to export the following classes of goods to all destinations: containers, collapsible, wholly or mainly of lead, tin or alloys containing either of these metals; butyric acid and its salts and esters and preparations thereof; ethanolamine (mono-, di-, and tri-); gas detector paint; iron oxides; and tin oxides, whether hydrated or not.

The existing licence requirements with respect to chromium compounds; lead acetate; lead arsenate; lead chromate and pigments containing lead chromate; and lead tetra-ethyl and mixtures containing lead tetra-ethyl are superseded by the provisions that licences will in future be required to export the following: chromium compounds (other than barium and zinc chromates) and preparations thereof (except distempers, lacquers, varnishes, paints and painters' enamels prepared or ready mixed, and pigments

containing lead chromate); lead compounds; mixtures containing lead tetra-ethyl and (to certain specified destinations) pigments containing lead chromate.

Hexamine, the export of which was previously prohibited to all destinations outside the British Empire, will now require licences for all destinations. Copies of the Order will shortly be available from H.M. Stationery Office, or booksellers, price 1d.

## Sale of Fertilisers

The Minister of Supply has made the Control of Fertilisers (No. 20) Order, 1942, which until June 15, 1942, limits forward sales of triple or other superphosphates, potash or basic slag, or a compound fertiliser containing these materials. Retail distributors may only sell for application to the land by the buyer not later than June 30, while manufacturers and wholesale distributors may not sell for delivery after that date. The object of the Order is to encourage the use this season of all available stocks of the fertilisers in question. The Order (S.R. and O., 1942, No. 593) came into force on April 2.

## British Chemical Prices

### Market Reports

CONDITIONS in the market for general chemicals have followed very much the same course as during the previous week, and the volume of inquiry for new business has been on a small scale. There have been no changes in the supply position, and the flow of contract deliveries to the main consuming industries has been steady. Offers of yellow prussiate of potash are very scarce, while supplies of bichromate of potash and permanganate of potash are on the tight side. Amongst the soda products hyposulphite of soda and chlorate of soda are firm and in strong request. The position of the acids remains unaltered, with supplies of oxalic below current requirements. Among the coal tar products there is a good demand for creosote oil and carbolic acid, and values are holding well on a quiet demand.

MANCHESTER.—Although holidays have been curtailed in the Manchester area compared with a normal Easter, there has not been a great deal of inquiry circulating on the chemical market locally, and sellers report only moderate additions to order books. On the whole, however, allowing for a certain amount of seasonal interruption, deliveries of textile and other industrial chemicals under contracts have kept up at a reasonably satisfactory level. Actual price changes during the week have been few. Inquiry has also been less active in the by-products section, though here again good quantities of both light and heavy materials have been taken up under existing commitments.

GLASGOW.—There is no change from last week in the Scottish heavy chemical trade. Home trade remains normal. Export business is still very difficult. Prices keep very firm.

## SYNTHETIC FUEL FROM LEAVES

Shortage of fuel in France has led to experiments in the manufacture of "synthetic coal" from leaves, the resultant product being known as Carbofeuille. So far only a small quantity of this fuel has been manufactured, but Vichy is interested in the process, and new plant will be built to place production on a national scale.

Briefly, the process is as follows: the leaves—which give off a gas, pyroligneous acid, and a tar—are gathered and carbonised (the gas is used for carbonising other leaves, after being mixed with coal gas). The carbon is then finely crushed, mixed with water and coal tar (the tar derived from the leaves is too hard), pressed into the shape of nuts and left to dry for three or four days. Experiments show that the heat of combustion stands at 4800 calories, and that about 1 cwt. of fuel can be made from the leaves of an average tree. Thus the 89,000 trees of Paris would give 4450 tons of fuel. This, however, would have the disadvantage of costly collection and transport, and it has been pointed out that a scheme for making fuel by this method will be economical only if carried on in or near forests, such as the Bois de Boulogne.

The quantity of coal gas necessary for carbonisation would decrease in ratio to the size of the plant, and only 70 lb. of tar would be necessary for 1 ton of the nuts.

## General News

The first meeting of the newly-formed Newcastle-upon-Tyne Section of the Oil and Colour Chemists' Association was held on April 8, with Mr. A. J. Gibson, immediate past-president of the Association, in the chair.

A consolidated index of abstracts bearing on Shellac Research Literature for the period 1928-1940 has been published by the London Shellac Research Bureau, India House, Aldwych, W.C.2. At the same time the list of abstracts and patents on the same subject for the year 1941 has also been issued.

In consequence of the curtailed supply of tin the Non-Ferrous Metals Control has decided to release from April 1 aluminium for the manufacture of milk bottle caps. Dairymen will be doing a valuable service if they can ensure the greatest possible return of used caps for salvage.

Rough exploratory tests, reported by Bacharach and Coates to the Society of Public Analysts, have confirmed the presence of vitamin P in various citrus concentrates, in a reaction-mixture obtained by partial esterification of highly purified hesperetin, in rose-hips and rose-hip syrup, in blackcurrant juice (pasteurised) and in blackcurrant purée.

The Minister of Agriculture stated recently that much could be done to increase the output of fertilisers—especially lime and phosphates—without making increased calls on shipping; and very much more could be achieved by a more rational distribution of available supplies. Fertilisers should be apportioned according to the needs of the soil and on the advice of experts attached to the Executive Committees. The price of "mixtures" and proprietary brands should be as firmly controlled as the price of straight fertilisers, and the question of distribution must be tackled boldly.

Among the names of over 600 firms and persons in neutral countries with whom trading is illegal, according to the Trading with the Enemy (Specified Persons) (Amendment) (No. 5) Order, 1942 (S.R. and O. 1942, No. 493), the following may be of interest to readers of THE CHEMICAL AGE: Morzeletto S.A. Establecimientos Metalurgicos, Helguera 1481, Buenos Aires; Fabrica de Productos Quimicos y Farmaceuticos, Carpio 105, Mexico City; and "Socoder" Soc. pour le Commerce des Combustibles et de leurs Dérivés, Corraterie 7, Geneva, Productos Quimicos y Farmaceuticos "Ciba," Lopez 35, Mexico City, is deleted from the list.

The scheme for the drastic rationing of motor tyres, which came into force last Saturday, April 4, is designed to meet what is officially described as "Britain's very critical rubber position." Car tyres may not be bought except at 1200 selected depots in Great Britain and Northern Ireland, and everyone must accept what is offered. Only retreaders licensed by the Ministry of Supply will be allowed to carry on business. A saving of at least 1,000,000 tyres on private cars alone is expected, as well as 10,000 tons of rubber on giant tyres. It will be a breach of the law for a private owner to transfer tyres to another person.

It is well known that the Red Cross and St. John Fund is spending over £2,000,000 a year on providing food, clothing, comforts and medicines to more than 100,000 British prisoners of war and civilian internees. But that is only one branch of Red Cross work, and altogether the organisation is spending approximately £5,000,000 a year. At present 8,000,000 contributors to the Penny-a-Week Fund provide about two-fifths of that sum, but it is hoped that, as the result of a new appeal by the chairman of the Fund, many thousands more employers, large and small, will come into line in providing facilities for their workers to contribute to the fund.

## Foreign News

Twenty-five oil, chemical, and rubber companies are taking part in the United States synthetic rubber programme. According to a statement made by Mr. Jesse Jones, Minister of Commerce, plants with an annual capacity of 700,000 tons of synthetic rubber will be brought into operation within 18 months.

## From Week to Week

Bauxite is being exported from Southern France to Italy, according to Press statements, at the rate of more than 250 truck loads daily.

Manufacturers of nitrocellulose lacquers in Brazil are using castor oil with or without dibutyl phthalate as a plasticiser in pigmented lacquers. Imported alkyd resins are being used largely by the paint industry in place of domestic resins.

Bismuth production in Mexico during the first eight months of 1941 amounted to 64 metric tons, all of which was exported. Arsenic production amounted to 8508 metric tons, of which 8302 were exported. The 11,643 tons of graphite produced in the same period was all exported.

Potassium permanganate is used in Ecuador in the manufacture of pharmaceutical preparations and in gold-mining operations. Imports of potassium permanganate averaged 4000 pounds during 1937 and 1938, but declined in 1939 and 1940. Imports in 1937 and 1938 were supplied chiefly by Germany.

Control of the Consolidated Dyestuff Corporation has been sold by the Canadian Custodian of Enemy Property to Mr. John Irwin, of Montreal. Before the war the Corporation was mainly German-owned, but the German interests have been extinguished since the company was taken over in 1939 by the Custodian of Enemy Property. The new proprietor has changed the name of the company to Irwin Dyestuff Corporation, but the company will continue to represent General Aniline and Film Corporation of the United States, and General Dyestuffs Corporation in Canada, and will import supplies from them.

## Forthcoming Events

There will be a meeting of the Electrodepositors' Technical Society at the Northampton Institute, St. John Street, E.C.1, at 5.30 p.m., on April 13, when a paper on "Experiences in Alkaline Zinc Plating" will be read by J. S. Jones and P. M. Walker.

The annual general meeting of the Yorkshire Section of the Society of Chemical Industry will be held, at a joint meeting with the Food Group, at the Hotel Metropole, Leeds, at 3 p.m., on April 13, when, under the general heading of "Colour in Foods," papers will be presented by D. J. T. Bagnall, F.I.C.; Professor J. W. Cook, F.R.S.; D. A. Harper, Ph.D.; and N. Strafford, F.I.C.

"Laboratory Design" is the title of the discussion which will be opened by Mr. J. McKillop, Mr. W. E. Prytherch, and Mr. P. L. Bilham, at the meeting of the Society of Chemical Industry, to be held in the rooms of the Chemical Society, Burlington House, W.1, at 2.15 p.m., on April 13.

A joint meeting of the Chemical Engineering Group (Society of Chemical Industry) and the Institution of Chemical Engineers will be held on April 14, at 2.30 p.m., in the rooms of the Geological Society, Burlington House, W.1, when a discussion on "The Development of New Chemical Processes" will be opened by H. M. Cremer, M.Sc., F.I.C., M.I.Chem.E., chairman of the Chemical Engineering Group.

At a meeting of the London and S.E. Counties Section of the Institute of Chemistry, to be held at the Institute on April 15, at 6 p.m., Dr. Hugh Nicol will speak on "The Use of Chemicals by the Green Plant."

The Royal Society of Arts is holding a meeting at John Adam Street, Adelphi, W.C.2, on April 15, when J. C. Dawes, O.B.E., M.I.Mech.E., Deputy Controller of Salvage, will be speaking on "Making Use of Waste Products."

The Chemical Society announces that the Sir Joseph J. Thomson Memorial Lecture will be given by the Right Hon. Lord Rayleigh, F.R.S., in the Lecture Theatre of the Royal Institution, at 4.30 p.m., on April 16.

There will be a general meeting of the Institution of Mining and Metallurgy in the Rooms of the Geological Society, Burlington House, London, W.1, at 2.30 p.m., on April 16.

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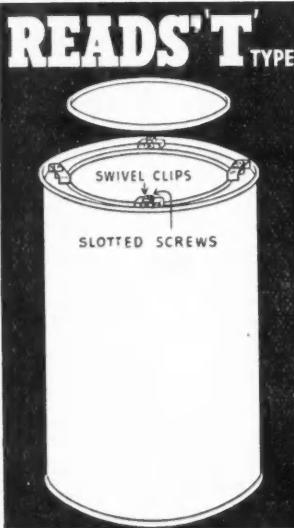
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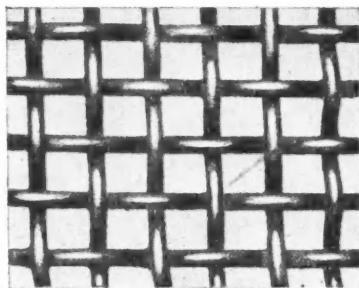
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## Company News

**W. J. Bush and Co., Ltd.**, report an interim dividend of 4 per cent., less tax, on the ordinary shares (same).

**Electrolytic Chemical Products, Ltd.**, 12 Brewery Road, N.7, have changed their name to Deosan, Ltd.

**William Blythe and Co., Ltd.**, have declared a final dividend of 10 per cent., making 15 per cent. for the year (same).

**Stewarts and Lloyds, Ltd.**, announce a final dividend of 12½ per cent. (same) on deferred stock.

**The Indestructible Paint Co., Ltd.**, announce a final dividend of 12½ per cent. making 20 per cent. (same) for 1941.

**Lacrinoid Products, Ltd.**, report a net profit for 1941 of £25,457 (£16,493), and have declared a final dividend of 5 per cent., making 9 per cent. (7 per cent.).

**London and Thames Haven Oil Wharves, Ltd.**, announce that they are unable to make payment of any dividend on 4 per cent. cumulative redeemable preference shares for the year ended March 31, 1942.

**The Manganese Bronze and Brass Co., Ltd.**, report net profit for 1941 of £101,784 (£146,857), and have declared a final dividend of 17½ per cent., making 25 per cent. for the year (same).

**F. W. Hampshire and Co., Ltd.**, report a net profit for the year to December 5 last, of £61,140 (£73,140), and have declared a final dividend of 20 per cent. on both ordinary and "A" ordinary shares (same).

**The Burmah Oil Co.** have declared dividends on the 6 per cent. first preference, 6 per cent. second preference, and 8 per cent. preference stocks for the half-year ended December 31.

**Xoline, Ltd.** (formerly Carburants Trading Trust, Ltd.), Kingsbury House, 15 King Street, S.W.1, has changed its name to Process Oil Products, Ltd.

**Pinchin, Johnson and Co., Ltd.**, announce a net profit of £310,859 (£330,347). Stocks in enemy hands to the value of £19,471 were omitted from last December's inventories. A final dividend of 6 per cent. has been declared, making 8½ per cent. for the year (same).

**William Briggs and Sons, Ltd.**, propose to reduce their ordinary share capital from £100,000 to £75,000 by returning to shareholders 5s. on each £1 ordinary share, and reducing the nominal amount of each share to 15s. It is then intended to increase the share capital to the former amount by creating 25,000 ordinary shares of £1.

## New Companies Registered

**Imperial Chemical (Pharmaceuticals), Ltd.** (373,052).—Private company. Capital: £500,000 in 500,000 shares of £1 each. Manufacturers of and dealers in fine chemicals, scientific apparatus and materials, oils, colours, dyewares, etc. Subscribers: A. J. Quig; E. A. Bearden. Registered office: Wexham Road, Slough, Bucks.

**W. Hornett, Ltd.** (372,872).—Private company. Capital: £1000 in 1000 shares of £1 each. Manufacturers and processors of oils, fats and chemicals, tallow and oil refiners, soap boilers, manufacturers of and dealers in greases, unguents, etc. Directors: F. W. Hornett; E. E. Hornett; S. Balon. Registered office: 10 Essex Street, W.C.2.

**Victoria Chemical Company, Ltd.** (372,769).—Private company. Capital, £500 in 500 shares of £1 each. Manufacturers of and dealers in chemicals, disinfectants, soaps, polishes, fertilisers, oils, colours, etc. Directors: F. H. Pollard; Hilda A. Robertson; Jessie Pott; Janet H. Webb. Registered office: New Mills, near Stockport.

**Mendip Quarrying and Contracting Company, Ltd.** (372,819). Private company. Capital, £15,000 in 15,000 shares of £1 each. Manufacturers of and dealers in asphalt, bitumen, oil and coal tar products, stone-crushers, engineers, paint and varnish manufacturers, manufacturing chemists, etc. Subscribers: F. W. Edmonds, Cecil F. Cooper. Solicitors: Slaughter and May, 18 Austin Friars, E.C.2.

**Ault and Viborg Plastics, Ltd.** (372,833).—Private company. Capital, £1000 in 1000 shares of £1 each. Manufacturers of and dealers in plastics, synthetic resins, chemical substances and products, paints, varnishes, enamels, coatings, colours and dyestuffs and their transformation products and derivatives, etc. Subscribers: H. F. W. Rudd; J. Bennett. Registered office: 71 Stamford Road, S.W.18.

**Gypsum Company of Ireland (1942), Ltd.** (373,017).—Private company. Capital: £10,000 in 10,000 shares of £1 each. Manufacturers, transporters and exporters of gypsum rock, minerals, ores and deposits, manufacturers of and dealers in ceramic ware, manufacturing chemists, etc. Subscribers: Joan R. Fisher; Joan R. Owen. Solicitors: Kenneth Brown, Baker, Baker, Essex House, Essex Street, W.C.2.

## Chemical and Allied Stocks and Shares

**Q**UIET and inactive conditions have continued to rule in the stock and share markets, where the prevailing disposition is to await war developments and the Budget statement. Sentiment was assisted by the absence of heavy selling and also by the firm undertone maintained in British Funds, while among industrial securities steadiness was shown in various instances, pending important results and dividend announcements.

Imperial Chemical at 32s. 9d. were higher on balance, in advance of the preliminary statement for the past year's working, which will be published by the time these notes are read. L.C.I. 7 per cent. preference were firm at 35s. 9d., while elsewhere B. Laporte have transferred around 63s. Associated Cement were dull at 45s. on continued market fears of a "cut" in the dividend, but elsewhere Tunnel Cement were steady at 38s. 3d., awaiting the financial results. British Plaster Board were maintained around 31s. Lever and Unilever were little changed at 28s. 9d., but there was increased activity in various classes of preference shares of the group, which made improved prices. British Oil and Cake preferred ordinary were 41s. A point of interest was the improvement to 15s. 3d. in Amalgamated Metal shares, the market now being hopeful of a small increase in the forthcoming dividend.

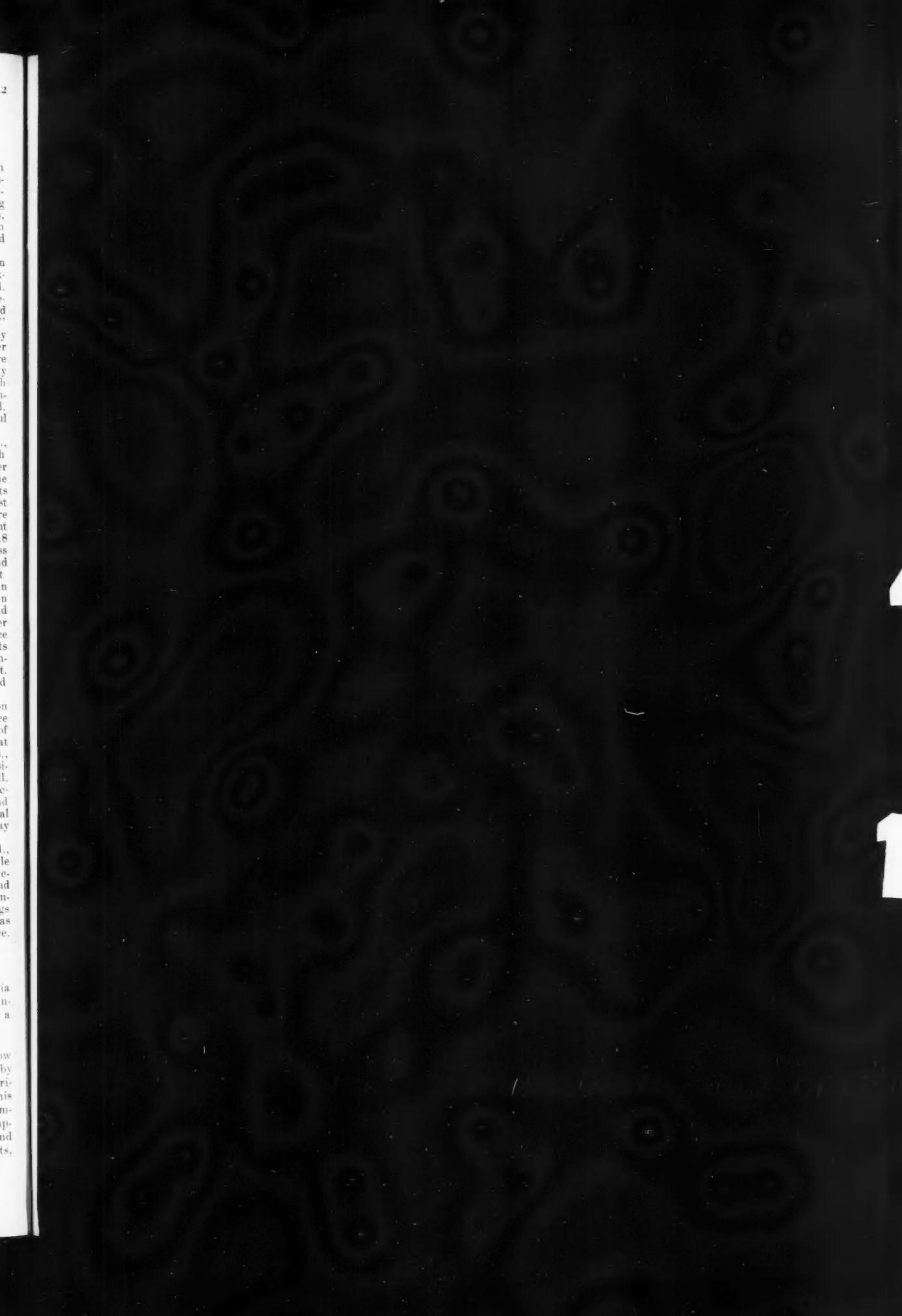
There was a better tendency in British Oxygen at 67s. 3d., pending the full results and annual statement. British Aluminium were firm at 43s. 6d. Borax Consolidated further improved to 31s. 6d.; there were a number of dealings in the preference units and debentures, the recently-issued results having tended to draw attention to the good cover for interest requirements of these securities. United Glass Bottle were around 55s., and remained firmly held, it being pointed out that earnings on the ordinary shares were approximately 18 per cent., or 6 per cent. above the distribution on this class of capital. Canning Town Glass shares transferred around their par value of 5s., awaiting the dividend announcement. Elsewhere, there was a small improvement to 65s. 6d. in Turner and Newall, while Murex improved to 92s. 6d. in advance of the interim dividend announcement. Nairn and Greenwich kept at 55s., but Barry and Staines were easier at 28s. 9d. United Molasses also had an easier appearance at 28s. 9d., but at the time of writing Distillers ordinary units have remained steady at 73s. 9d. British Match were unchanged at 34s. 3d., awaiting the dividend announcement. Moreover, in other directions, Pinchin Johnson improved slightly to 21s. 9d. pending the preliminary results.

Iron and steel issues continued to be assisted by satisfaction with recent dividend statements, particularly the maintenance of Stewarts and Lloyds payment at 12½ per cent. Shares of the last-named company have had a steady appearance at 46s. 6d., while Tube Investments were 82s., United Steel 23s., and Babcock and Wilcox 44s. 6d. In other directions, business at 24s. 6d. has been recorded in Cooper McDougall. Fison Packard were again quoted around 39s., but were inactive. Blythe Colour 4s. shares transferred at 5s. 3d., and Erinol 5s. ordinary were around 7s., while British Industrial Plastics 2s. shares were quoted at 3s. 6d. Leeds Fireclay preference shares were dealt in at 6s. at one time.

Among other securities, Boots Drug were steady at 32s. 9d., and Southalls (Birmingham) changed hands around 24s., while British Drug Houses were 25s. 6d. There were few movements among textile shares, but British Celanese first and second preference were firm, having remained under the influence of the dividend payments. Greiff-Chemicals Holdings 5s. units were around their par value. Business at 26s. was recorded in Morgan Crucible 5½ per cent. first preference. Where changed, oil shares were slightly lower on balance.

**Production of crude oil** in the Devoli district of Albania amounts to roughly 13,000 tons per month, and will be increased through exploitation of the sources in Patos, says a recent announcement in the Italian press.

**The Minerals Yearbook**, the 1941 edition of which is now available, is an authoritative reference work, published by the U.S. Bureau of Mines, and written and edited by authorities in the field of mineral economics and technology. This new edition contains the most comprehensive data ever assembled on production, stocks, distribution, trade, and consumption of metals, non-metals, fuels, and mineral products, and can be obtained from the Superintendent of Documents, Washington, D.C., price \$2.



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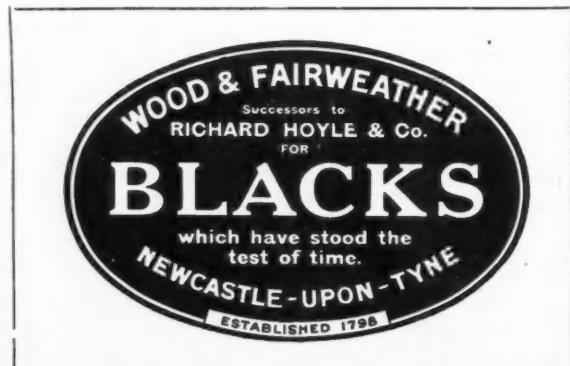
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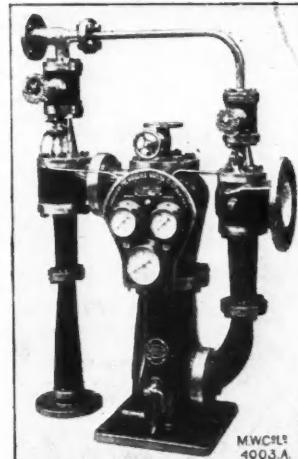
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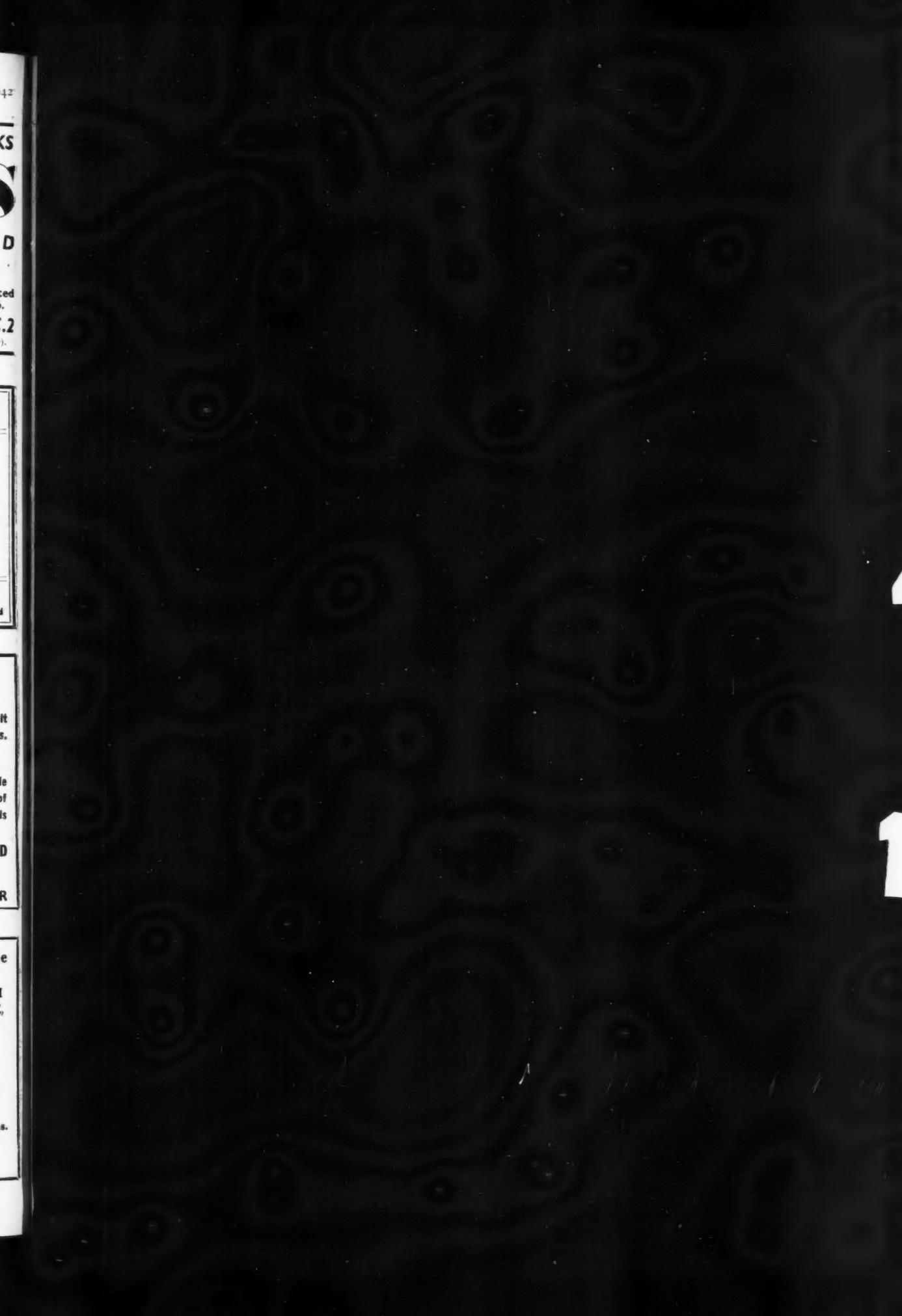
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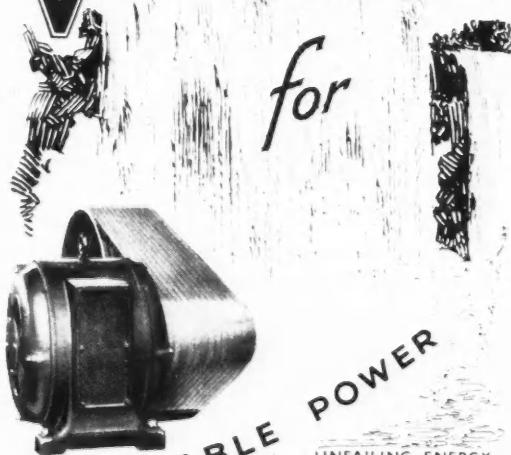
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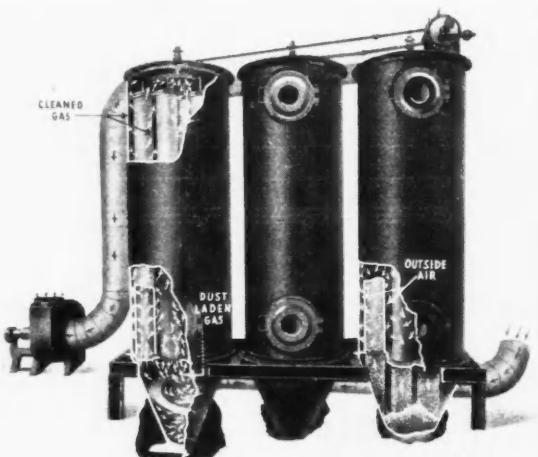
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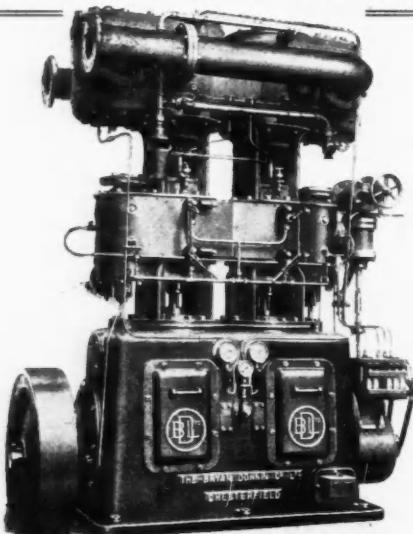
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